Small Enterprise Association of Australia and New Zealand
26th Annual SEAANZ Conference Proceedings
11-12 Sydney 2013

Suppliers versus Lead Users: The Case of Open Innovation in Small Firms

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Abstract:

This research aims at exploring the effects of new product development (NPD) collaborators on innovation performance in small firms. Two major groups – corporate suppliers and lead users – are investigated to determine the comparative impact they had on innovation performance through their involvement in open innovation initiatives in small firms. Four hundred and fifty-two small-sized consumer product manufacturers were analysed using factor analysis and multiple regression analysis, revealing that lead users have a significantly higher positive impact on the company's innovation performance than do suppliers.

Keywords: open innovation, lead users, suppliers, new product development, small firms, supply chain collaboration.

INTRODUCTION

The unremitting quest for competitive edge along with the calamitous effects of the financial crisis in 2007 placed businesses in an unenviable position. The requirements of meeting customer demands for lower prices while maintaining, if not improving, product quality, while concurrently dealing with strict and ever more stringent budget lines, made businesses search for an almost miracle solution. However, scholars from different straits of life, funded by universities and industry alike, have come to the rescue, delving into the different possible alternatives that may help businesses solve these challenges. Research has mainly focused on the role of innovation in providing new products or improvements that might be higher in quality, lower in cost, and most importantly satisfy a new need.

Previous research focused on consumer products, as they presented the highest potential for growth in addition to the greatest applicability to businesses trying to reach out to their customers with new products (Al-Zu'bi and Tsinopolous, 2012; Von Hippel et al., 2010). Innovation in consumer products can be seen as the most reliable approach to steer away from financial shortages and lengthy new product development projects. Innovation may provide solutions that are out of the box, cost and time effective, and most inventively create new needs and wants for costumers thus neutralising the effect of product price on customer's decision making. The most current method for capturing innovation is open innovation, which was championed by Chesbrough (2003). Open innovation is reliant on external sources for ideas, from a broad spectrum of experts and even collaborators.

Open innovation provided a new alternative for companies to expose themselves to new ideas and to subvert the old-fashioned closed innovation approach which was had been the overriding theme of the previous century. The closed innovation concept was based on a heavy investment in internal human skills and in head-hunting the brilliant minds for full-time employment, and then allocating huge budgets for their research initiatives and projects, and in ensuring the protection of the created products through trademarks, copyrights, and patents. This tended towards a never-ending cycle, as most of the profits would be invested in future recruitment and research (Elmquist, Fredberg, and Ollila, 2009).

In contrast, open innovation provides companies with a completely new paradigm that capitalises on the ability to reach to a wider audience of talented minds from around the globe with widely diverse backgrounds and experiences. These external collaborators tend to approach innovation in a very different manner: in general, they have a greater breadth of career experience, and are motivated by completing individual tasks well, rather than by seeking salary or status. Open innovation has provided a mechanism for companies to approach these professionals. Recent years have seen new financial arrangements of the new millennium, an increase in venture capitalism and well-protected copyrights, which increase the ease with which innovative ideas can be transferred and traded (Elmquist, Fredberg, and Ollila, 2009; Dahlander and Gann, 2010). Open innovation decreases the required investment in alluring employment contracts to attract leading intellectuals and in the ensuing research. Instead, companies can leverage their new product development (NPD) initiatives from a much smaller budget for external collaboration, and they can enjoy a new innovative culture through exposure to external innovators. Open innovation also provides the opportunity for internal NPD projects to be profitable outside the company, since the exchange is a two way mechanism (Jessup, Reed, and Storrud-Barnes, 2012).

Open innovation began in big businesses, and research into open innovation has therefore been focussed on larger companies. Few studies have attempted to investigate the role of innovation, particular open innovation, in small businesses. Open innovation is far easier to study in larger firms, as small enterprises tend to have less access to external resources, fewer technological assets to exchange, and insufficient capabilities to manufacture, distribute, market, and sustain extended research and development (Lea et al 2010). Interestingly, small enterprises have traditionally been more likely to utilise non-internal means of innovation than large firms, considering partnerships and networks an efficient way to gain much-needed technological know-how (although this can often be seen in the form of allying with larger firms or simply outsourcing to other companies). Another reason that research has neglected small enterprises is that such companies are more likely to seek external sources for the later, phases of innovation (marketing and commercialisation) rather than the earlier phases (research and development – R&D) that research on open innovation tends to cover (Lea et al 2010).

In addition to these factors, innovation in small enterprises is harder to track. Only half of all small firms reserve a specific budget for innovation, and only a third write down a formal plan to implement it. Research shows that innovation in small enterprises often comes not from formal R&D, but simply from daily business development, customer collaboration, and general attempts to improve efficiency. This creates difficulty in distinguishing innovation developments from general business activities, possibly remaining 'hidden' from even the innovators themselves (Forsman, 2011).

Despite the challenges in such studies, small firms are actively involved in developing new products that are both innovative and likely to yield competitive advantage, and their collaboration with external partners in the NPD process can achieve these results. The benefits of external collaboration has been affirmed by studies on collaborative new product development (Al-Zu'bi and Tsinopoulos, 2012), indicating that NPD initiatives had higher success rate when external collaborators were involved. The advantage of involving corporate collaborators, such as suppliers, with valuable expertise, market knowledge, and capital investment can give the host company a competitive advantage over their rivals, since the corporate collaborators would help them to save on the expected costs of new product development. But just as valuable is collaboration with individual partners whose mentality is similar to that of consumers, leading to decreased R&D costs. This is particularly true for the group of lead users, a specialised class of individual collaborators with heightened needs to satisfy their wants that are not met by the market's products through bespoke solutions that are usually innovative.

The rapid movement of knowledge across the world, the ever increasing merchantability of technology, along with the defragmentation of innovation centres, have proved that open innovation is the preeminent method for seizing the abundance of external knowledge opportunities and nurturing the collaboration with external partners such as suppliers and lead users (Al-Zu'bi and Tsinopoulos, 2012; Von Hippel and De Jong, 2010). Numerous studies have examined the role of external collaborators in new product development (Littler et al., 1995; Mikkola and Skjoett-Larsen, 2004), but the role of these partners in the innovation process, particularly in the setting of open innovation and in the context of small businesses, remains unexplored. This research attempts to provide such required insight to experts, industry, and academia by investigating the relative effects of those two groups on innovation performance in small firms.

Five main dimensions will be used to study small businesses' innovation performance: meeting technological demands, introduction and modification of new products, number of patents, ideas volume and quality, and effectiveness and efficiency of ideas implementation. The relative effects of suppliers and lead users will be simultaneously examined in new product development through open innovation. This study will endeavour to investigate which of the two external collaborators will have a greater impact on innovation performance. Such comparison will be of benefit for both academia and industry. Academically, this paper will add to the literature regarding the collaboration of corporate and individual partners in open innovation. Moreover, it will provide practical advice to small businesses that may help them weigh their future collaboration partners in their future initiatives. This should assist small businesses in introducing new products to the markets before their competitors thus providing a source for sustainable competitive advantage. The following sections will explain in detail the theoretical development of the study, followed by the methodology used, data analysis, and finally the findings and recommendations.

CONCEPTUAL DEVELOPMENT

Despite a focus in the literature large firms, there is no statistical evidence that these firms should be superior to small enterprises in utilising new innovation techniques, including open innovation (Laursen and Salter, 2004; Lea *et al.*, 2010). In fact, earlier studies suggest that small enterprises are as innovative as large firms, despite employing far fewer internal resources and generally having insufficient capacity to manage the entire innovation process (Fai and Tomlinson, 2013). Small enterprises are able to accomplish this feat by utilising their external networks more effectively than large firms, enabling them to shorten innovation time, reduce risk and cost, increase operational flexibility, and realise higher R&D productivity rates (Lea *et al.*, 2010).

Open innovation also differs greatly between small enterprises and large firms, because of the disparities in their innovation processes. While large firms focus heavily on R&D in their open innovation efforts, small enterprises tend to focus on commercialisation and marketing. This is because although small enterprises may have superior technology needed for invention, they generally lack the manufacturing faculties, marketing channels, and global connections needed to bring these inventions to the market. This leaves them with the option of entering into supplier-customer relations with a large firm, outsourcing, or forming strategic alliances with other small enterprises.

Although partnering with a large firm would allow small enterprises to benefit from scale and an abundance of resources, there are considerable drawbacks. A small enterprise may be obliged to share its technological know-how with the larger firm, losing the opportunity to compete with large firms even as it gains the opportunity to work with one. They could also be required to produce cheap goods in order to meet the large firm's lowest specifications, setting back innovation developments for the small enterprise.

Instead, a network of small enterprises appears to be the sounder option. This allows companies to share risks and profits through efficient co-development of products and services. It also helps individual firms to decipher and utilise flows of information on technological change, sources of technological assessment, particular market requirements, and strategic decisions made by other companies. Additionally, since small enterprises often specialise in a specific area, these networks

help to facilitate entrance into wider markets, discover complementary services, increase core competencies, and benefit from prior innovation experiences (Lea *et al.*, 2010; Fai and Tomlinson, 2013). Despite the obvious benefits that come with networking – horizontal or vertical, professional or personal - building a network can be difficult for small enterprises, given the need for a comprehensive database of knowledge or the financial resources to gather reliable information on competitors, customers, and potential collaborators (Lea *et al.*, 2010; Ceci and Iubatti, 2012). This process can be further held back through lack of trust, intimidation by more dominant partners, or a fear of becoming 'over-embedded' in relationships (Fai and Tomlinson, 2013). In a recent study, Forsman (2011) found that the majority of small enterprises in the manufacturing sector had very low levels of input through external networks. However, there are examples of successful networks being built. The Korean Integrated Contract Manufacturing Service (KICMS) was founded in 2004 to encourage networking among Korean small and medium enterprises (SME) and establish cross-functional collaborative consortiums. So far, a number of these consortia have been created, combining different firms to handle R&D, marketing, manufacturing, and other aspects – thus allowing these small enterprises to compete against large firms (Lea *et al.*, 2010).

This brings the notion of open innovation to the doorstep of the small business, as it provides the mechanism by which greater collaboration, and much more cost effective, is established. The concept of open innovation is familiar to mainstream companies which have maintained some sort of exchange between the internal systems of the organisation and the external world through bringing in new ideas, resources, and individuals (Frishammer, Grönlund, and Sjödin, 2010). Freeman (1974) emphasised this notion through the example of the research and developments departments which have been rarely disconnected from the external world. However, open innovation is a more extensive approach to external collaboration Chesbrough (2006). The purpose is to create links between the different sources and practices to spread the knowledge between the different sectors and across a wider population of businesses. The myriad of benefits that companies enjoyed from open innovation led to a quick expansion into new sectors of the industry and with much larger representation.

The impressively rapid adoption of open innovation coincided with increasing attention to collaborative new product development projects which were also spreading throughout many industries. The swift and fluctuating increase in customer desires, in parallel with the shorter product life cycles associated with such volatility, forced companies to seek more efficient and economic ways to develop new products quickly. Collaborative product development offered manufactures reduced development cost, wider product scope, and increased productivity (van Echtelt *et al.*, 2008; Al-Zu'bi, 2008). Most scholars in innovation, sought to identify the benefits of such partnerships, focussing on collaborators as a source of innovation. Von Hippel's lead user concept (1998), for example, ministered a practice to expect the functional sources of innovation through identifying the expected innovation returns in order to manipulate them. Others studied the role of the supply chain, and suppliers in particular (Dowlatshahi, 1997; Frohlich & Westbrook, 2001). Researchers focussed on the resource-based view, in which they were linking the acquisition of experience and knowledge to the success of NPD initiatives (Foxall & Johnston, 1987; Handfield, Ragatz, Petersen, & Monczka, 1999). In small firms, however, the role of suppliers in open innovation and the link to the company's innovation performance has never been established.

In important group of collaborators that has been studied extensively by scholars to measure their impact on innovation performance are lead users. Lead users are a very special group of customers who experience needs and wants which are not yet satisfied by the market, and who have great desire and interest in finding solutions to these needs. A number of studies investigated the relative impacts of suppliers and lead users, focussing mainly on the quality of ideas and the acquisition of new techniques that will allow a large firm to gain access to partners' resources and knowledge, and leverage complementarities with them (Dahlander and Gann, 2010). However, the effects of collaboration upon the company's innovation performance have not been established, particularly in small businesses. This research will conduct a direct comparison between these two external partners, and measure their effect on innovation performance along the five main dimensions presented herein.

Suppliers' NPD collaboration and innovation performance in small businesses

Suppliers are well-documented in the literature to support the internal processes of the company with which they collaborate (Bidault & Butler, 1998). Research has focussed on operational performance (Frohlich & Westbrook, 2001). Dahlander and Gann (2010) suggested that supplier collaboration enables firms to commercialise products to the benefit of both partners, but they caution that out-licensing a firm's own product may be difficult due to 'over-commitment'. The benefit comes mainly from exposure to the external party's resources, thus starting a process of incremental innovation.

Supplier involvement can also cause logistical difficulties in collaboration, and the risk of leaking knowledge and ideas to competitors. This is the main reason why many companies are still hesitating to participate in open innovation. Such resistance to join the open innovation approach puts the company at the risk of not sustaining its company's competitive advantage, in addition to the internal commitment and loss of opportunity to train employees to think outside the box (Frishammer, Grönlund, and Sjödin, 2010). As mentioned earlier, suppliers' input in NPD processes has been measured only with respect to cost and time and not in the context of small firms. The company's innovation performance serves as a better indicator for the success of the collaboration as it relates to meeting customers' demands regardless of the size. Since suppliers are renowned to possess greater market knowledge, then collaborating with them should assist the manufacturing company to better use that knowledge to meet the customers wants, hence our first research hypothesis:

H1: the greater the supplier's collaboration in new product development processes through open innovation in small firms, the greater the company's innovation performance.

Lead users' NPD collaboration and innovation performance in small businesses

Lead users are characterised by their higher needs and expectations than regular users. They vigorously try to find solutions to their problems and needs, and this usually provides innovative new processes or products (Luthje & Herstatt, 2004; Morrison, Roberts, & Hippel, 2000). In response to intensive efforts to introduce a suitable framework for involving lead users, Lilien *et al* (2002) proposed an approach to help companies benefit from their lead users and to use their input in NPD. Other work also investigated the compatibility between the goals of lead users and the capabilities

and desired outcomes of the company (Eliashberg *et al.,* 1997; von Hippel, 1998). Lead users have since been attributed to many radical innovations and positive effects in NPD, such as greater efficiency, decreased cycle times, and reduced costs (Hamann, 1999; Lonsdale & Newell, 1996). Nonetheless, there has been debate in the innovation literature about whether lead users increase collaboration costs, and raise the risk of a partner acting opportunistically against the firm's interests. There is also a challenge in evaluating external ideas with less first-hand information than for internal ideas. If lead users are brought in, the company risks becoming overly dependent on customer views and being limited to only incremental innovation (Frishammer, Grönlund, and Sjödin, 2010; Dahlander and Gann, 2010). Nonetheless, lead users are acknowledged to have many positive impacts on innovation, leading to the second hypothesis of this research:

H2: the greater the lead users' collaboration in new product development processes through open innovation in small firms, the greater the company's innovation performance.

EMPIRICAL ANALYSES

Research instrument development

This study used a specific questionnaire prepared according to Dillman's total design method (TDM) (1978). The tool underwent several stages of validation to increase its accuracy. Items were selected from the literature, aiming to measure degree of collaboration for both lead users and suppliers in open innovation (Mikkola, 2003; Al-Zu'bi & Tsinopoulos, 2008). Questions were designed to measure the involvement of external partners in open innovation (OI), in parallel with questions measuring their impact on innovation performance. The questionnaire comprised 8 items to measure the collaboration for each of the suppliers and lead users, and 7 items to measure the dependent variable – the company's innovation performance. A further refinement involved a pilot study of 32 NPD managers, which gave an item-to-total reliability test indicating the fitness of the items used and Cronbach's α-values between 0.90 and 0.95, indicating internal consistency and reliability of the items and the constructs used (Cronbach, 1951).

Data collection

A questionnaire was sent by express carrier (premium post) to a random sample of 800 small firms consumer product manufacturers in three major economic zones; Europe, North America, and East Asia. These are areas in which industries are extensive; there is availability of data on joint NPD projects; and an overriding trend towards innovation and joint collaboration in NPD. 452 complete questionnaires were received and analysed, representing a response rate of 56.5%. Small businesses from various industries such as car accessories, supporting electronic devices, software, telecommunication applications and personal care participated in the study and sent back their completed questionnaires filled in by their new product managers, operations managers, and development managers.

Non-response bias was tested for by analysis of early responses (first month: n = 230) and late responses (second month: n = 222) using the Mann-Whitney U test and the Kolmogorov-Smirnov (K-S) test. These tests indicated no significant difference between the two groups, refuting the existence of any non-response bias.

Model specification

The theoretical framework of this research comprises two main hypotheses, which examine the relationships between innovation performance (the dependent variable) and collaboration with suppliers and lead users (the independent variables). These relationships were controlled by the firm size (measured by the number of employees), the firm's age in years, and the length of the relationship between the lead users and suppliers on one hand and the sponsoring company. The following regression model was therefore formulated to examine the research hypotheses:

$$IP = \beta 0 + \beta 1\ FS + \beta 2\ FA + \beta 3\ SL + \beta 4\ SCOI + \beta 5\ LUCOI + \varepsilon$$

Where: IP = Innovation Performance; β0 = constant; β1, β2, β3, β4 and β5= coefficients; FS = firm size; FA = firm age; SL = length of relationship, SCOI = suppliers' collaboration in open innovation (OI); LUCOI = lead users' collaboration in OI; and ε = error

RESULTS AND ANALYSIS

Sample description

Control variables were analysed using descriptive statistics of central tendency and dispersion. The categorisation of the companies was probed to confirm generalizability over a wider manufacturing industry, and not just in a certain sector. The companies involved in this study were small according to a combination of defining bodies; the Australian Fair Work Act 2009 and the European Union, Small Business Act for Europe, which both defined small business according to the number of employees. Thus for the purpose of consistency this research considered firms with less than 50 employees small and hence only companies which were less than 50 in the United States were sent Questionnaires although the definition there goes up to 500 employees. However companies varied in age, background, type of industry, and length of relationship with NPD partners. The largest group of the companies (46%) were less than 10 years old, with the remainder distributed almost equally between the other categories of age. Moreover, the companies were a good representation of different industries; with almost one quarter of them in the electronics and electricals sector (25%). The length of relationships was generally long, with more than 34% of companies having had a long relationship with the partners over 10 years.

Measure reliability and validity

To more rigorously validate the tool, Cronbach alpha coefficients for the constructs of suppliers' collaboration and lead user collaboration (each comprising 8 items) and innovation performance (7 items) were tested again, giving coefficients of 0.86, 0.96, and 0.95 consecutively, which is considered high (Hair *et al.,* 2006). Convergent and discriminant validity tests for the constructs employed indicated high validity (Gerbing & Anderson, 1988). Confirmatory factor analysis revealed a comparative fit index (CFI) of 0.90, and a root mean square error of approximation of 0.04, both within acceptable limits (Hair *et al.*, 2006). Finally, comparison of the variance extracted (VE) for each of the constructs to the square of the correlation estimate confirmed acceptable internal consistency and validity, warranting the subsequent interpretation of results.

Factor analysis

Exploratory factor analysis (EFA) was required in order to conduct meaningful hypothesis testing and for the purpose of reducing the number of items that will be used in the subsequent regression analysis. EFA was performed without any limitation to the number of factors. Preliminary tests were performed to ensure the suitability of the data for factor analysis. A measure of sample adequacy (MSA) was calculated for each variable (Hair *et al.* 2006) and all showed correlation above 0.5 and therefore were retained. The Kaiser-Meyer-Olkin value was 0.9, which is considered good by the scale of Kaiser (1974), and the Bartlett's test of sphericity showed statistical significance. The data was therefore concluded to be factorable.

Table 1: Exploratory factor analysis: factor structure

Supplier variables	Setting general product definition	0.222	**0.663**	0.131
	Setting lead time requirements	0.232	**0.699**	-0.130
	Setting product specifications	0.201	**0.709**	0.035
	Generating product's blueprint/ drawings	0.291	**0.788**	0.054
	Designing product detailed specification	0.198	**0.880**	0.077
	Product prototyping	0.299	**0.784**	0.173
	Product testing	0.090	**0.865**	0.072
	Overall NPD process	0.010	**0.899**	0.191
Lead user variables	Setting general product definition	**0.790**	0.211	0.059
	Setting lead time requirements	**0.878**	0.012	0.146
	Setting product specifications	**0.874**	0.034	0.134
	Generating product's blueprint/ drawings	**0.622**	0.333	0.022
	Designing product detailed specification	**0.801**	0.190	0.004
	Product prototyping	**0.833**	0.054	0.128
	Product testing	**0.754**	0.177	0.149
	Overall NPD process	**0.811**	0.177	0.140
Innovation Performance	Meeting technological demands	0.222	0.175	**0.651**
	Introducing new products	0.091	0.190	**0.765**
	Modifying products	0.191	0.222	**0.679**
	Number of Patents guaranteed	0.155	0.099	**0.797**
	Number of Proposals	0.172	0.272	**0.810**
	Proposals turned into projects	0.281	0.188	**0.791**
	Projects successful implementation	0.251	0.121	**0.685**
	Eigen Values	7.758	6.901	5.920
	Percentage of variation explained	30.335	27.221	23.342
	Cumulative Percentage	30.335	57.556	80.898

Extraction method: Principal component analysis

Rotation method: Varimax with Kaiser Normalisation

Table 1 shows that the exploratory factor analysis loads on three main factors. The first factor loads highly on lead user (LUCOI) variables and the second factor loads highly on suppliers (SCOI) variables, while the third factor loads highly on items relating to company innovation performance.

Statistical tests

Multivariate statistical analysis was carried out using set-wise regression analysis, to test the model using the summated scores of the independent factors and the control variables on company's innovation performance. The regression results, shown in Table 2, indicate a significant statistical association between lead users and a company's innovation performance, and a similar one between suppliers and innovation performance. The control variables showed no significant association, which supports the generalisability of this model across the different backgrounds of the companies. The R^2 value of the model is satisfactory, and the ANOVA test of the model indicates high significance (p=0.000), confirming that this model has statistical strength to explain the relationship. There is a significant relationship between the supplier variable and company innovation performance (SCOI is significant at p<0.001), and a significant relationship between the lead user variable and OI (LUCOI is significant at p<0.001) with standardised coefficients of β_4 = 0.29 and β_5 = 0.43 respectively, suggesting a positive direction of the relationship. As noted above, suppliers have a weaker relationship with innovation performance, while lead users have a stronger association with the company's innovation performance. The results of the regression analysis support both hypotheses of the research and indicate the association between the level of collaboration of suppliers and lead users in NPD through open innovation on the increased company's innovation performance. Lead users do seem to have a higher impact than suppliers, which should generate future research into the reasons behind this higher statistical association.

Table 2: Hierarchical Regression Model: Company's Innovation Performance

	Unstdized Coeffs		Stdized Coeffs	t	Sig.
	B	Std. Error	Beta		
Step 1					
(Constant)	4.023	.446		10.553	.000
Company size (number of employees)	-.033	.031	-.020	-.254	.664
Company age	-.021	.038	-.128	-1.457	.280
Length of relationship	.038	.035	.132	1.351	.338
r	.055				
R^2	.003				
Adjusted R^2	.001				
Regression *F*-value	5.616				
Step 2					
(Constant)	5.014	.311		10.144	.000
Company size (number of employees)	-.029	.023	-.055	-.455	.632
Company age	-.033	.030	-.030	-.438	.635
Length of relationship	.227	.204	.034	2.004	.464
Supplier Collaboration in OI	.290*	.101	.215*	3.296	.001
Lead Users Collaboration in OI	.430*	.135	.430*	4.931	.000
r	.663				
R^2	.439				
Adjusted R^2	.406				
R^2 Change	.403				
Regression *F*-value	9.954				

Note: * p<0.001

CONCLUSIONS

This paper has aimed to study the effects of collaboration with suppliers and lead users through open innovation on the innovation performance of small businesses. Analysis of the questionnaire data indicates a strong positive relationship between the innovation performance of a company and collaboration with both lead users and suppliers. These results provide necessary empirical evidence for the effects of small firms' external collaboration, particular with respect to the provision of quality ideas while not burdening the company or weakening its ability to innovate. These findings are consistent with the premise of the paper, that external collaboration is essential in the post-financial crisis era for small firms as it helps maintain competitive advantages despite diminishing budget allowances. The recovery of the world economy is dependent on innovation, as it is an important catalyst for NPD to meet the demand in very difficult financial times. Notably, these findings highlight the value of these specific groups of collaborators and offer the contributions of each, allowing firms to compare their relative merits and make the best choice for their circumstances. The study found that greater advantage is to be gained from collaboration with lead users in small businesses, presumably due to the economic advantage of lower operating expenses, and due to time restrictions. Such recommendations have not been previously recognised in the literature and indicate that there is certainly great value to manufacturers in adopting these practices. The empirical evidence provided in this paper should aid researchers in further studying links between these groups and greater innovation performance.

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